

PHASES AND SPENDING PROFILES FOR A GEOLOGIC REPOSITORY: IMPLICATIONS FOR FINANCING A MULTINATIONAL REPOSITORY

International Framework for Nuclear Energy Cooperation
Reliable Nuclear Fuel Services Working Group

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Alan Brownstein

Former Associate Deputy Assistant Secretary, U.S. Department of Energy
and Co-Chair of the Reliable Nuclear Fuel Services Working Group

Session 1 Objectives

- Support this afternoon's discussions on creative approaches to financing a Multinational Repository (MNR) by presenting a generic view of a hypothetical repository project
- Based on data from current and planned repository projects in the United States, Canada, Sweden, Finland, England, and international organizations, this presentation will identify:
 - Key phases of a repository development
 - Nominal timelines associated with each phase
 - Nominal spending profiles of each phase
 - Implications for successfully financing a MNR project

Five Key Phases of Repository Development

1. Site Identification

- Screening
- Investigations (literature data and/or field work)
- Public involvement
- Selection

2. Licensing/Regulatory Approval

- Underground investigations
- Development of a safety case
- Preparation and defense of a license application

Five Key Phases of Repository Development (continued)

3. Construction

- Repository (surface and subsurface)
- Encapsulation plant (e.g., waste packages)
- Transportation infrastructure (rail/truck)
- Transportation casks

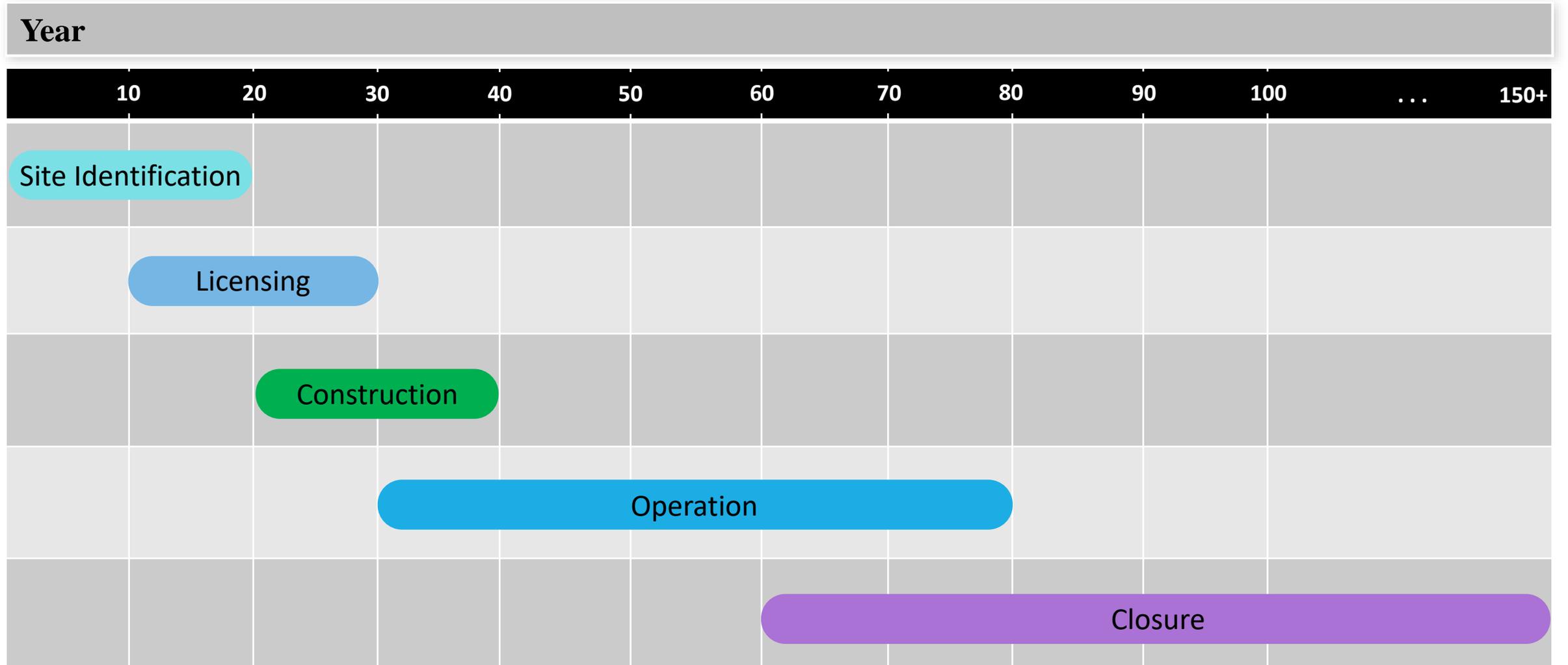
4. Operation

- Transport
- Emplacement
- Monitoring/performance confirmation

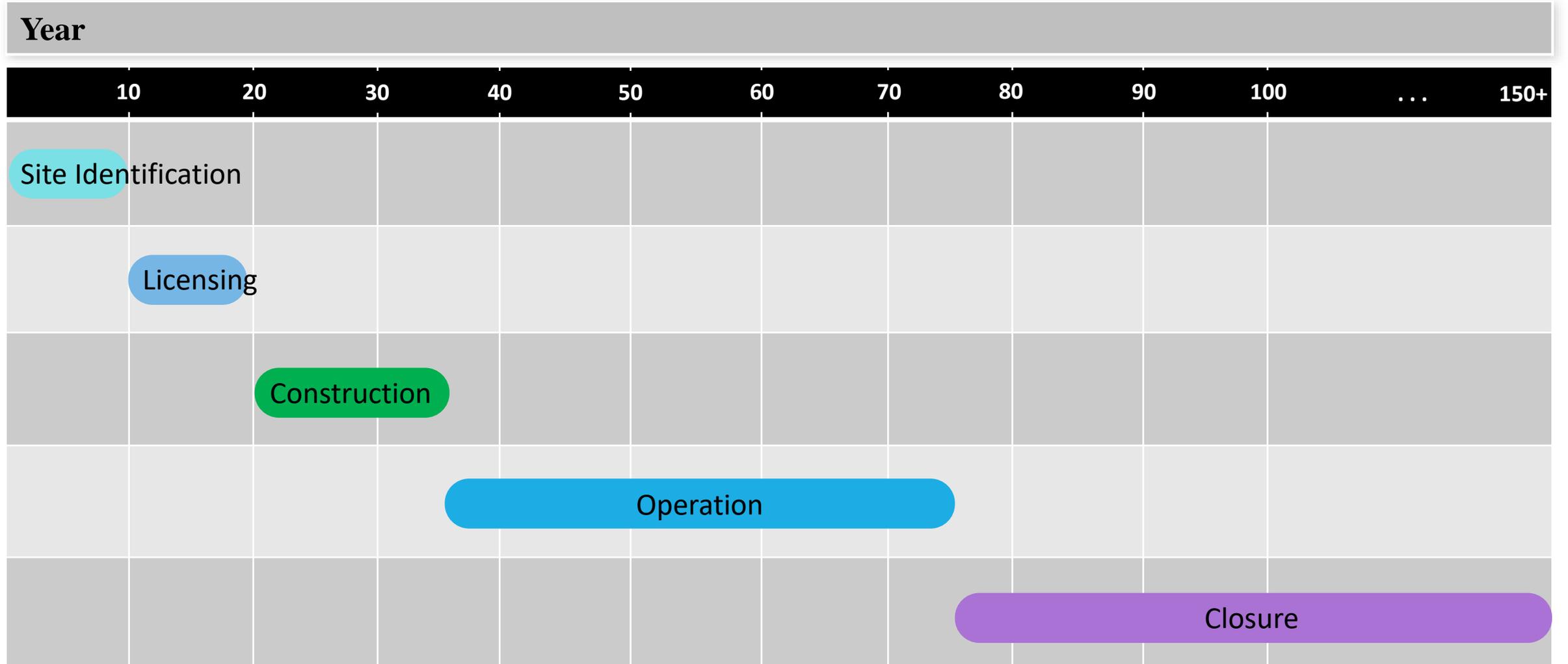
5. Closure

- Backfilling
- Sealing
- Decommissioning
- Performance confirmation and long-term monitoring

Time Ranges For Repository Phases



Notational Repository Phases



Repository Spending Profiles

- Despite differences in the planned regulatory sizes and costs, current examples of projected spending profiles show common features
 - Significant costs for siting and licensing
 - Highest annual expenditures during construction
 - Long period of operational costs
 - Total costs of construction and operation are same order of magnitude
 - Closure and monitoring costs are relatively small for a long period of time

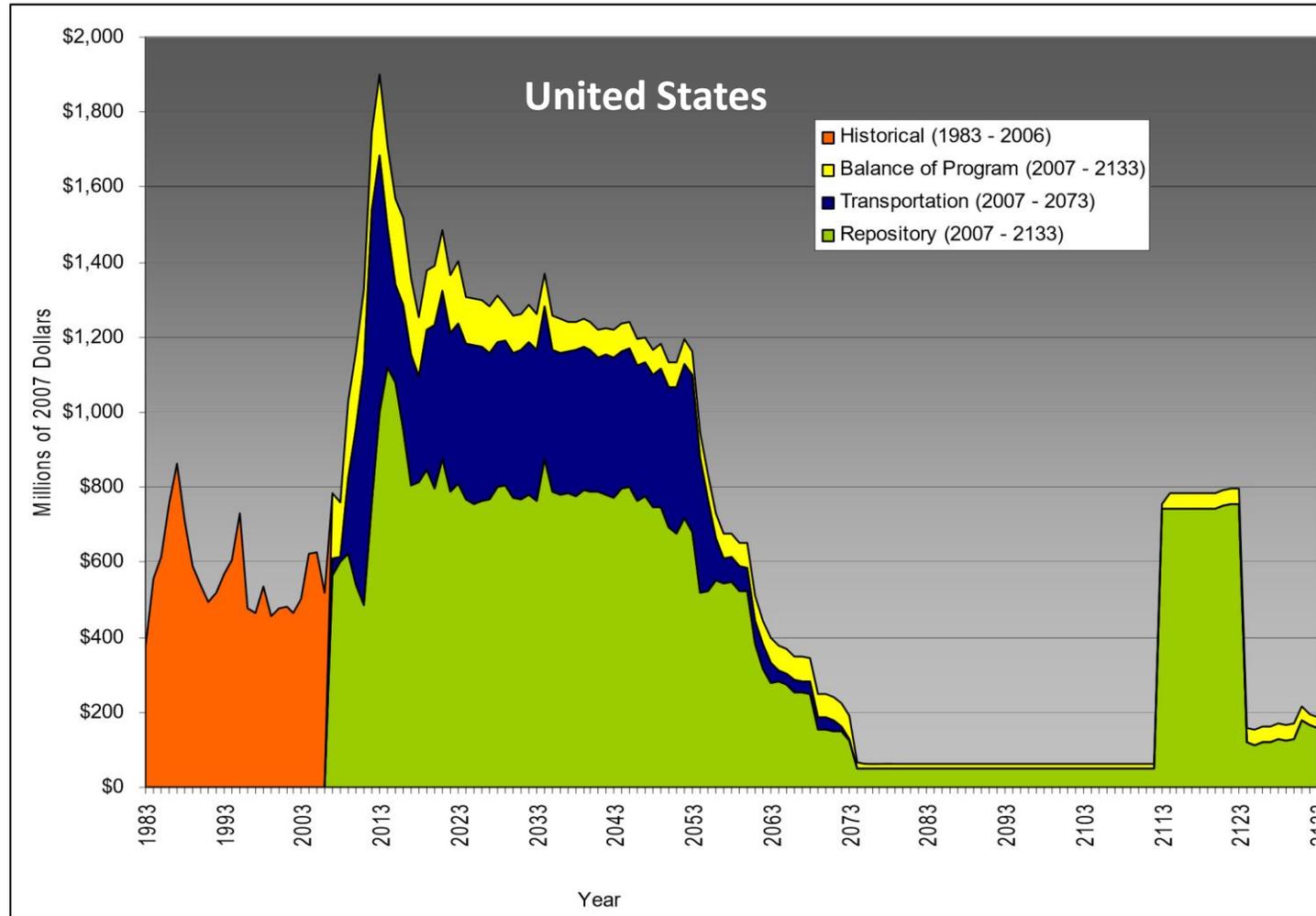
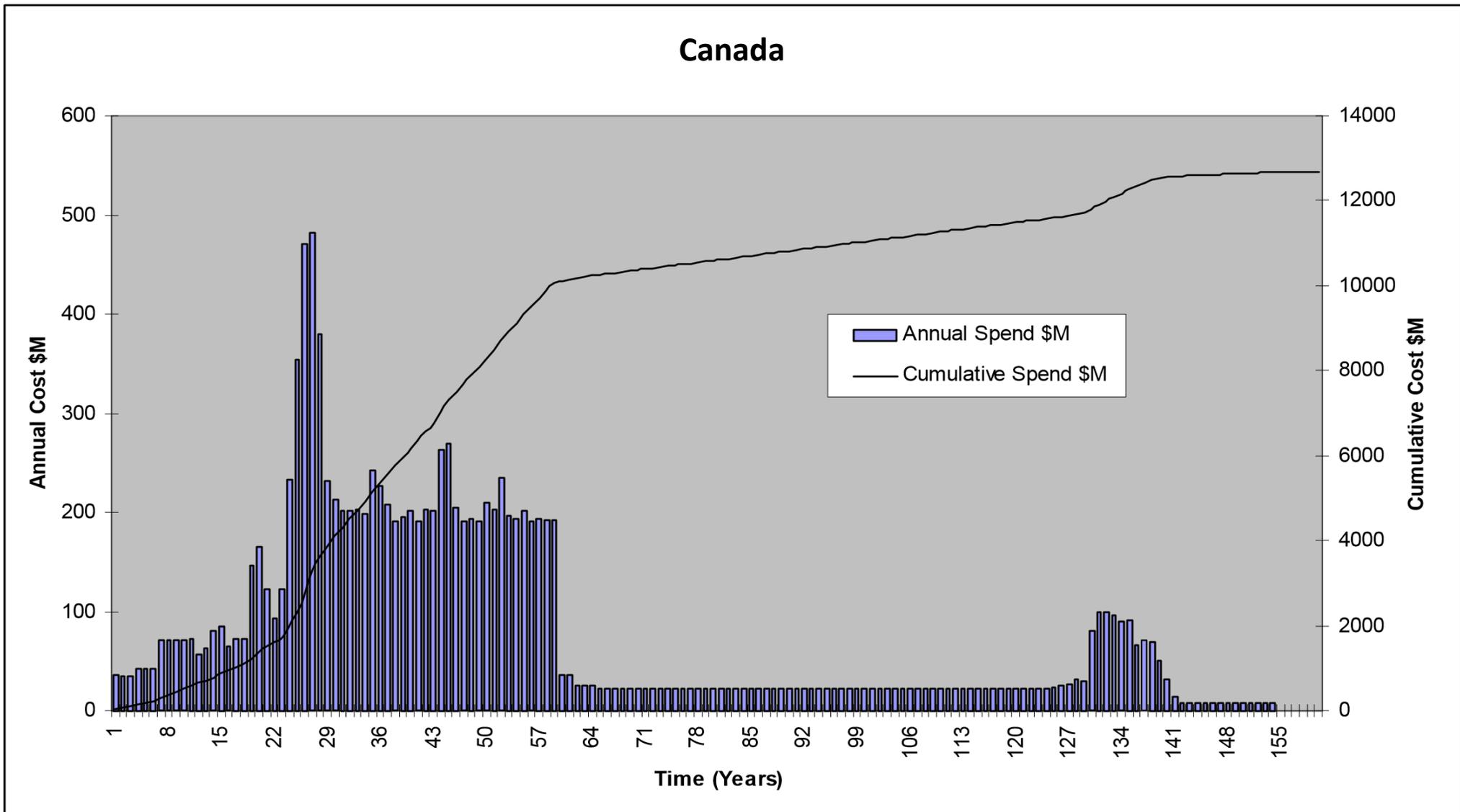
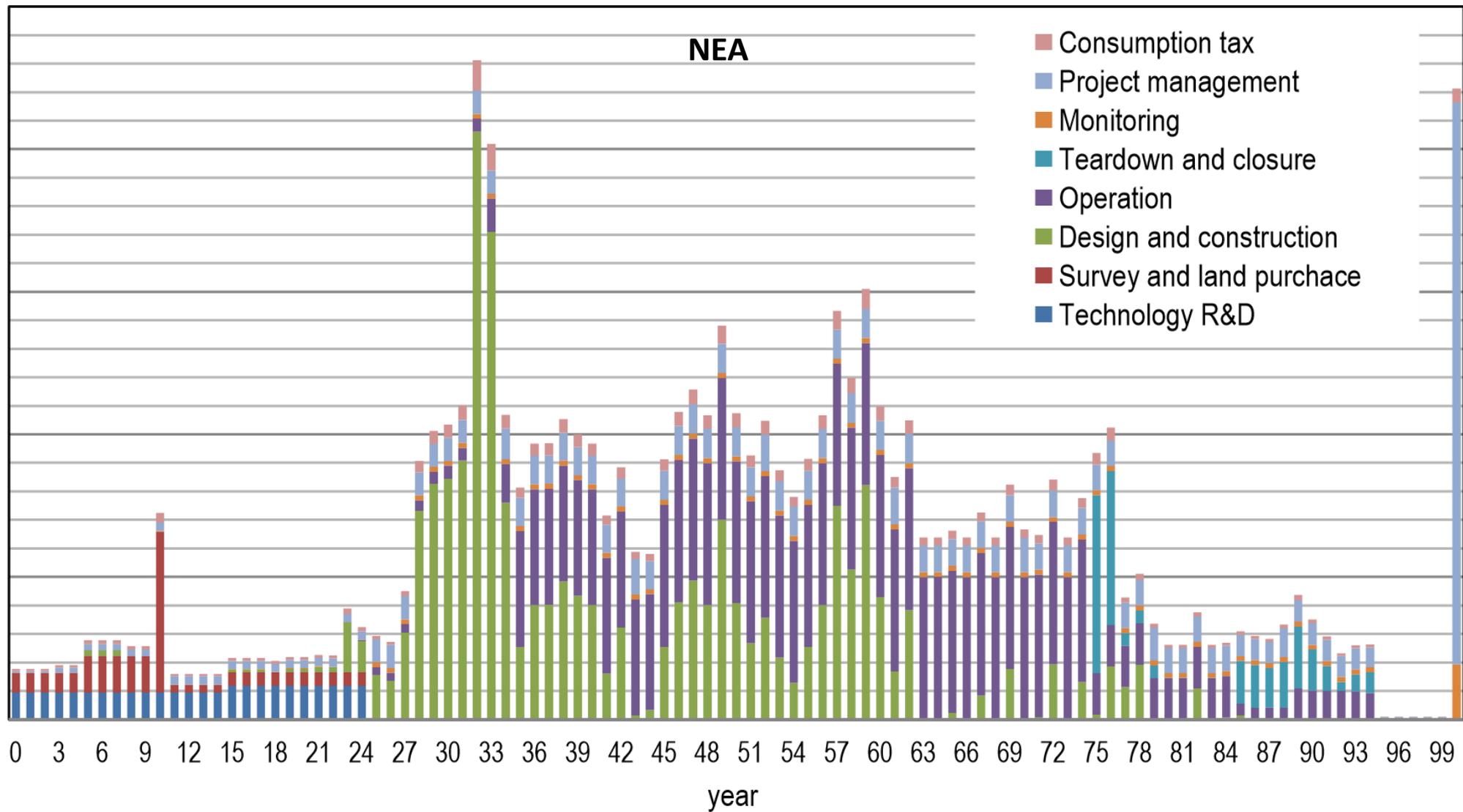


Figure B-1. Annual Total System Life Cycle Cost Profile

Analysis of the Total System Life Cycle of the Civilian Radioactive Waste Management Program, U.S. Department of Energy, July 2008.

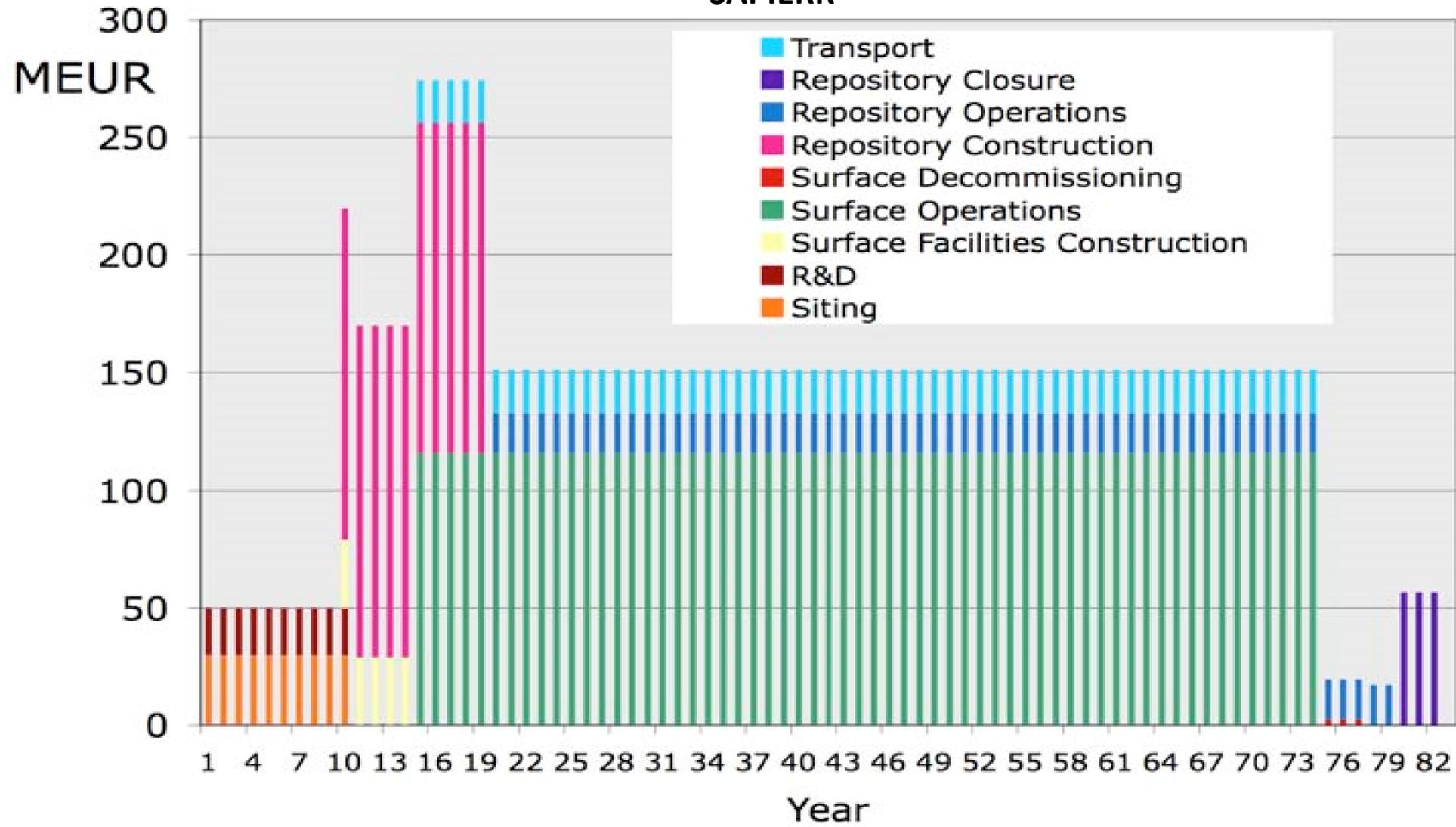


Cost Estimate for a Deep Geologic Repository for Used Nuclear Fuel, CANATOM, September 2003.



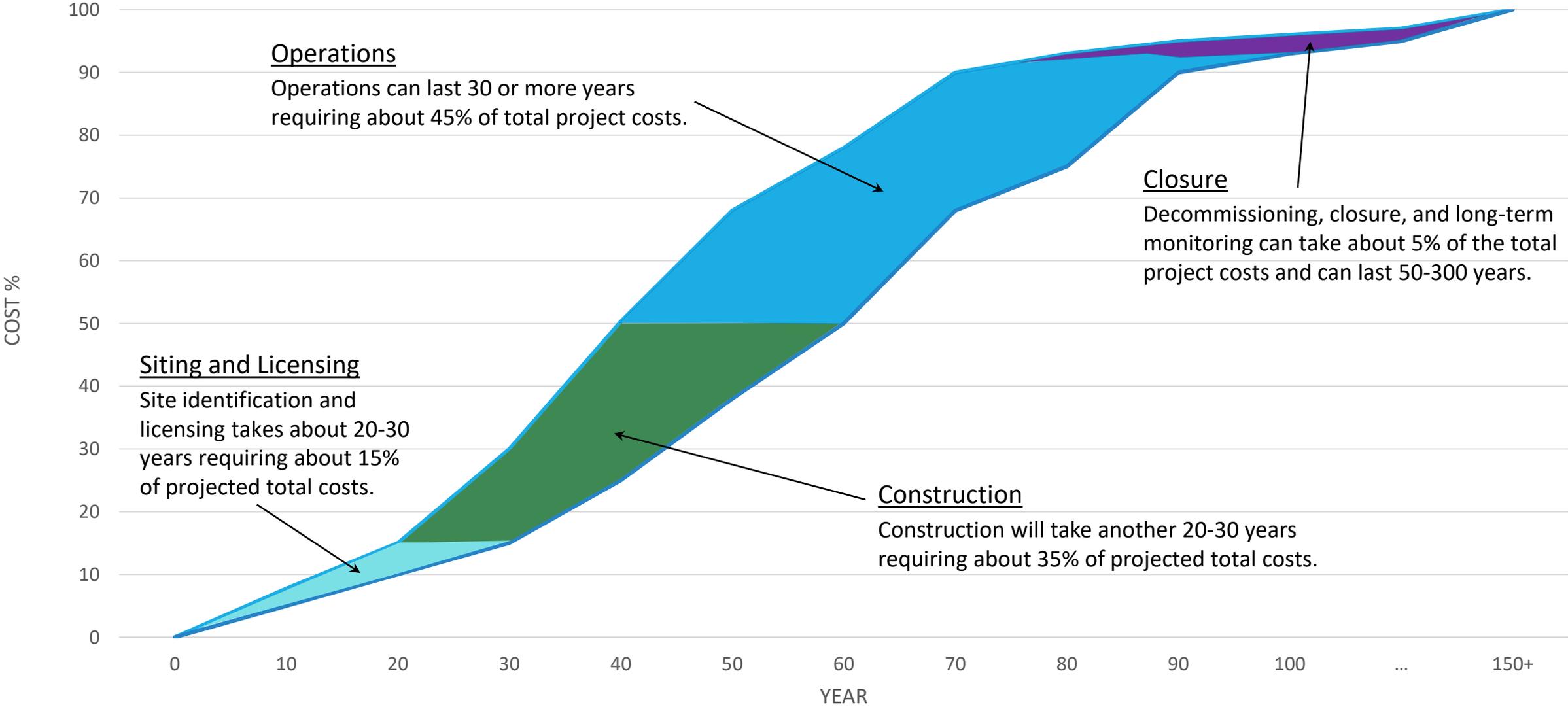
The Economics of the Back End of the Nuclear Fuel Cycle, NEA, No. 7061, 2013.

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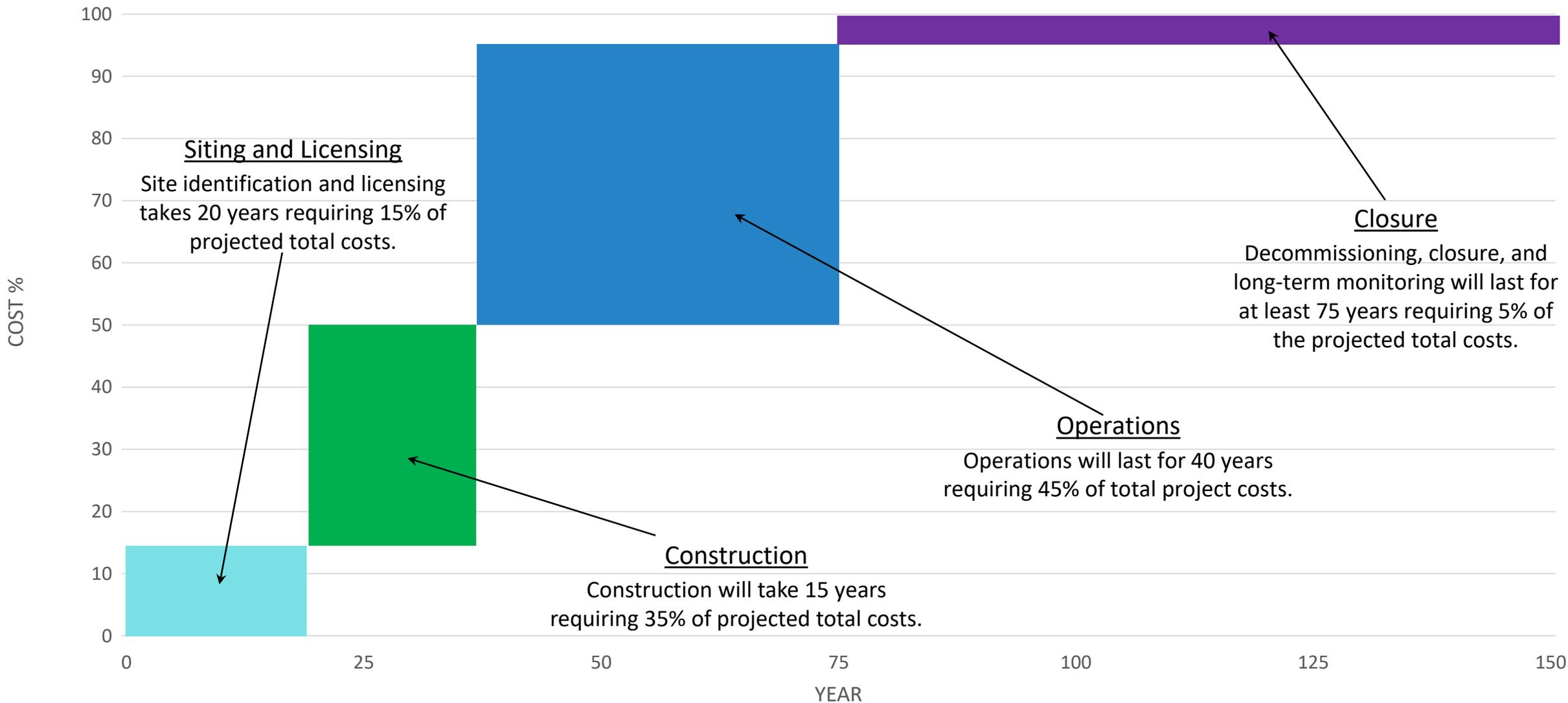


Strategic Action Plan for Implementation of European Regional Repositories, April 2008.

Repository Cost Ranges by Phases



Notational Repository Costs



Siting and Licensing

Site identification and licensing takes 20 years requiring 15% of projected total costs.

Construction

Construction will take 15 years requiring 35% of projected total costs.

Operations

Operations will last for 40 years requiring 45% of total project costs.

Closure

Decommissioning, closure, and long-term monitoring will last for at least 75 years requiring 5% of the projected total costs.

Key Challenges for Project Financing

- 35+ year period from initiation to commencing operations is beyond that of most construction projects
- Could be 30-50+ years from start of project before actual emplacement/disposal can begin
- Incurred project costs could be well over 50% before actual emplacement/disposal can begin

Different Financing Challenges of MNR vs. National Repository

- Funding for a national repository will depend on government controlled funding in most cases
- Funding for a MNR will depend on ability to finance the project until service to customers starts to generate sufficient revenue to become self sustaining

Conclusions – Part 1

- 35-40 year period from initiation to commencing operations is beyond that of most construction projects
- The initial siting and licensing phases do not require large upfront investments
- As much as 50% of the total costs are incurred before services can be provided
- Financing a MNR will be more complicated than a national repository
 - Issues associated with customers and funding do not apply in the case of a national repository that is funded typically directly by the government either through the federal budget or a government-managed waste fund

Finding innovative and effective approaches to financing will be one of the most important keys to advancing the MNR concept and successful development of a MNR.

What if ...

Assume that ...

- At least two national repositories have been successfully developed and are emplacing spent nuclear fuel
- Several countries were strongly supportive and committed to a MNR

Results

- The evolution from a First of a Kind Facility together with strong legal/political support could significantly reduce initial timeframes
 - Site identification could be reduced by as much as half, from 10 years to 5 years
 - Licensing could be trimmed from 10 years to 8 years
 - Construction could more confidently be completed in 10 years

Conclusions – Part 2

- Under these assumptions, the time from project initiation to waste acceptance could be reduced from 40+ years to 25 years or even slightly less
- More importantly from a financing perspective
 - The first 13-15 years are not cost intensive (about 15% of total project costs which could likely be funded without the need for outside financing)
 - The financing challenge then becomes how do you finance a project for 10 years before waste acceptance begins and generates revenues.